

UNITED STATES DEPARTMENT OF AGRICULTURE

Cotton Diversion Program

Proposal for Promoting Greater Utilization of
Cotton and Cotton Products in Road
Construction and Specifications
of Materials

The Secretary of Agriculture proposes to promote a greater utilization of cotton in road construction through the use of funds made available by Section 32, Public No. 320, 74th Congress, approved August 24, 1935, as extended by the Supplemental Appropriation Act, fiscal year 1936, (Public No. 440) approved February 11, 1936. Clause 2 of Section 32 of this act provides that certain moneys may be used to "encourage the domestic consumption of such commodities or products by diverting them, by the payment of benefits or indemnities or by other means, from the normal channels of trade or commerce. . .". That portion of Public No. 440, which is related to the above clause states, "That during the fiscal years 1936 and 1937 in carrying out clause 2 of said section 32, the Secretary of Agriculture may, if he finds that the purposes of said section will be accomplished thereby, purchase without regard to section 3709, Revised Statutes, agricultural commodities and products thereof, including purchases for donation to the Federal Surplus Commodities Corporation."

Two programs are contemplated, the first to divert cotton for use in cotton mats for the curing of concrete pavements and the second to divert cotton for use in cotton fabric to serve as membrane reinforcements in bituminous surface treatments. These uses of cotton and cotton textiles have never provided normal channels of distribution although, if the programs are successful, each may provide an important channel of distribution in the future.

In order to obtain a widespread distribution and use of these materials in highway construction, it is proposed that the Federal Government, through the Cotton Marketing Section and with the cooperation of the Bureau of Public Roads, in accordance with the provisions of the legislation cited above, shall make available to the highway departments of the various states such supply of cotton mats and cotton fabric as may be requested in amounts sufficient for adequate trials and demonstrations. These materials will be made available to the states on condition that the state highway department agrees to use them, or have them used, in an approved manner in road construction, and also upon the condition that the highway department use reasonable dili-

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gence in securing and recording such information as may be necessary for a future evaluation of benefits derived. The responsibilities of the Federal Government and the state highway department in connection with this transaction will be set forth in an agreement to be signed by both parties.

On account of its close association with the state highway departments and its paramount interest in highway construction, the Bureau of Public Roads has agreed to assist in furthering these programs by bringing them to the attention of the state highway departments and by assembling and transmitting to the Secretary of Agriculture the requests for materials as they are received.

Description of the two programs follows:

COTTON MAT PROGRAM

The cotton mats are to be used for curing concrete pavements in much the same manner that burlap is used for this purpose. The mats should be applied to the surface of the pavement as soon as possible after finishing. They should be wet thoroughly before application and should be kept wet until removal. The curing period should be not less than 72 hours and no further treatment is required subsequently. The flap which is specified along the edge of the mat is to insure complete covering of the pavement at the joints between adjacent mats. The mats are laid with the flaps in the direction of progress and each mat is laid on top of the flap of the preceding mat.

Information Desired

The efficiency of cotton mats for curing seems to be quite well established but it is desirable to have more information regarding the cost of curing when the mats are used under varying conditions.

It is desired that the state highway departments taking advantage of the opportunity to obtain a supply of mats under the proposed program agree to obtain data regarding the approximate average life of the mats and the average cost of curing per square yard of pavement under varying conditions and to report this information to the Bureau of Public Roads.

Specifications

Mats to be used in this program will be purchased by the Federal Government to meet the following specifications:

Materials. A cotton covering 40 inches wide, weighing 7 ounces per linear yard and known in the trade as "osnaburg", shall be used in

the manufacture of the mats. The raw material used in the manufacture of this cotton cloth shall be raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof. The tensile strength and other physical characteristics of the cloth shall be equal to those ordinarily specified in purchasing such material for industrial purposes. The filling material for the mats shall be a cotton "bat" or "bats" made of raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof, and shall weigh not less than 12 ounces per square yard. The grade of cotton used for this purpose shall be not lower than Good Ordinary and the foreign matter in the comber waste and card strips shall not be in excess of that ordinarily found in raw cotton of this grade. The thread used for sewing ends and flaps transversely and for the longitudinal stitching of the mat shall be approximately equivalent in size and strength to 3-cord number 32 cotton thread. The cotton thread for tufting shall not be less than 4-cord number 12s.

Dimensions. Mats of standard dimensions shall have a filler 5'9" in width and shall have a flap approximately 6" in width, consisting of an extension of two thicknesses of the covering material, extending along one longitudinal edge of the mat. Mats of standard dimensions shall be 32 feet 6 inches long. For curing roads of a width other than 20 feet and for curing half widths, mats of different length will be needed. In all cases the length of the mats shall be 2'-6" greater than the width of the pavement to be cured.

Construction. The covering material for each surface of the mat shall consist of two widths of cloth joined by a lapped seam. The cotton filling material, in the form of a bat or bats, shall be held in place between the covering material by sewing or tufting all around the periphery of the mat within 1 inch of the edge of the bat, and by sewing or quilting longitudinally at intervals not greater than 4 inches or by tufting at intervals not greater than 3 inches, both longitudinally and transversely. The sewing or tufting shall be sufficiently loose to permit substantially all of the surface of the mat to come in contact with the flat surface of the pavement when in use, but not so loose as to permit the filling material to shift. The flap shall be constructed by sewing the upper and lower coverings together longitudinally along one edge of the filling material and along the outer edge of the flap. In the finished mat the covering material shall be stitched together along both ends and both sides. The quilting shall be not less than 6 stitches per inch. All other sewing shall be at least 10 stitches per inch.

Tolerances. Mats shall not be less than the specified length by more than 1 percent nor less than the specified width by more than 2 percent.

Request for Mats

Approximately 80,000 mats of standard size, $22\frac{1}{2}$ feet long, (or the equivalent in mats of other lengths) will be furnished for the United States as a whole, if requested. Since the amounts requested probably will vary considerably in accordance with the paving programs with respect to states, individual state quotas have not been fixed. It is anticipated that offers can be accepted for mats sufficient for several introductory projects in each state having an extensive pavement program. Sixty days will probably be required to supply the mats after offers have been accepted. Therefore applications should be made early, especially where mats are desired for several projects.

Requests should be made in triplicate on the application form C. D. 2 to the District Engineers of the Bureau of Public Roads not later than May 1, 1936. Requests should specify the length or lengths of mats desired and the number of each length. The minimum number requested should be sufficient to cure a single project and greater numbers should be in multiples of this.

It is suggested that the mats furnished on any project should be sufficient to cure a length of pavement which can be laid in specified curing period plus about one-half day. Thus if the curing period is 72 hours, the mats furnished should be sufficient to cure the length of pavement which could be laid in about $3\frac{1}{2}$ days. If the rate of progress is 1,000 feet per day, about 600 mats would be required to provide for a $3\frac{1}{2}$ days' run of 3,500 feet.

FABRIC REINFORCEMENT PROGRAM

Experiments have been conducted over a period of years, especially in the State of South Carolina, to determine the value and feasibility of reinforcing bituminous surface treated highways with membranes of cotton fabric. Recently, interest in this field has become more widespread, and a number of projects have been so constructed and more are being planned. To date, however, the total mileage of such roads is small and most of it is confined to the State of South Carolina. In providing for widespread demonstration of cotton fabric for this purpose, it is desired that projects be so laid out that the benefits of the fabric will be readily ascertainable. It is desired, also to secure the significant data which will be obtainable from the use of this fabric reinforcement under a wide variety of climatic and other conditions which will be met in the operation of the program.

Method of Using the Fabric

The fabric is to be used as a reinforcement for thin bituminous surface treatments on previously consolidated bases of adequate thickness. The bases may be of the stabilized soil types such as sand-clay

top-soil, or sand-clay-gravel, or water-bound macadam or other types of base suitable for surface treatment.

The base is first primed with bituminous material and the fabric is then spread longitudinally in overlapping strips covering the full width of the primed surface. The general practice has been to spread the fabric while the prime is still sticky enough to hold it in place. This practice is advantageous in securing some impregnation of the fabric with the thin bituminous priming material.

As soon as the prime has cured sufficiently the surface treatment, consisting of one or more applications of bituminous material and crushed mineral aggregate, is constructed. In South Carolina, it has been the practice, just prior to the construction of the surface treatment, to spread crushed aggregate cover material over the cotton fabric, at the rate of 5 to 10 pounds per square yard, to protect it from damage by the wheels of the distributor.

It is recognized that there are a number of different methods of constructing thin bituminous surface treatments of satisfactory character. Therefore, in this program, the method generally favored by the State Highway department concerned will be acceptable, except that any method which involves mixing the bituminous material and aggregate on the road surface will not be suitable since the fabric would be likely to be displaced and damaged by the mixing operations.

In the experimental projects which have been built a wide variety of fabrics have been used but at present it is not known definitely what type of fabric may be most suitable for the purpose. It is desired to make some study of this feature of the construction and for this reason the specifications provide for three grades of fabric of different weight and strength.

Each project should contain not less than four sections, each section having a length of not less than 1/2 mile and preferably not less than 1 mile, constructed in a location where the base course, subgrade and drainage conditions are as nearly uniform as possible. On three of the sections the surface treatment should be reinforced; one section being reinforced with type A fabric, the second with type B, and the third with type C. The surface treatment on the fourth section should be exactly the same as on the first three sections, except that it should contain no fabric reinforcement.

While it is desirable that each project shall contain at least four sections, there is no objection to a greater number. In fact, on projects when subgrade and base conditions are not reasonably uniform a greater number would be desirable. In such cases the projects should be planned so that, for the different conditions

which obtain, adequate comparisons may be made between reinforced and non-reinforced treatments. For example, if a portion of the project has a good base and another portion a relatively poor one, the sections should be arranged so that comparisons may be made between reinforced and non-reinforced treatments on the good base and also between the two types on the poor base. The arrangement should not be such as to require that reinforced treatments on a good base be compared with non-reinforced treatments on a poor base, or vice versa.

It is desired, insofar as practicable, to have the three types of fabric used in approximately equal proportions. However, if there are projects on which it would be impracticable or otherwise undesirable to utilize all three types, then type B should be used.

The widths of fabric given in the specification are designed to completely cover roadway surfaces 18, 20 or 22 feet wide with three strips of fabric. In cases where it may be impracticable to use these widths as, for example, for surfaces of different width or when half-width construction is required, requests for fabric of other widths will be considered. For half-width construction on 18, 20 and 22 foot surfaces it would be practicable to use 4 strips of fabric having widths of 56, 62, and 68 inches, respectively. For 24 foot surfaces four strips, each having a width of 74 inches, should be used.

Information Desired

It is desired to obtain from the projects constructed under this program as much accurate information as possible relative to the behavior in service of reinforced treatments as compared with non-reinforced treatments, under comparable conditions, and also, for purposes of comparison, the costs of construction and maintenance.

To this end, the state highway departments making requests for supplies of fabric should indicate:

1. That the fabric is for use in experimental road construction.
2. That the projects will be so distributed in the state as to give information as to the utility of fabric reinforcement under various conditions, in a degree commensurate with the number of projects.
3. That the individual projects will be planned, insofar as practicable, in accordance with the general instructions given above.
4. That reports will be made to the Bureau of Public Roads giving the location of each project, the plan of the project, the specifications governing construction, the date of completion, the approximate volume of traffic, and all pertinent information regarding the type and character of base course, subgrade and drainage conditions.

5. That for purposes of accurate cost accounting, separate records of construction and maintenance costs, for the roadway surface only, will be kept for each section of each project; that construction costs will be reported to the Bureau of Public Roads immediately following construction and that maintenance costs, with descriptions of the maintenance performed, will be reported annually thereafter for the required period; and that the approximate volume of traffic will be reported annually. These reports will be made annually for 5 years or during the life of the surface, whichever is shorter.

6. That each project will be given a careful condition inspection at least once every six months and that reports of these inspections will be made to the Bureau of Public Roads.

Specifications

Cotton fabric used in this program for the reinforcement of bituminous surface treatments will be purchased by the Federal Government to meet the following specifications:

1. General Requirements of the Fabric. The fabric for use in bituminous surface treatments shall be free from avoidable imperfections of manufacture or other defects which may affect its appearance or serviceability.

2. Raw Materials Requirements. The fabric shall be made of raw cotton, cotton waste, or mixtures of raw cotton and cotton waste, from cotton grown and manufactured in the United States, of sufficient quality to obtain the fabric-strength and other requirements of serviceability indicated herein.

3. Yarn Requirements.

- (a) Ply. The yarn shall be two-ply.
- (b) Twist. The twist in the two-ply yarn shall be such as to give what is known in the trade as a "balanced twist".
- (c) Sizing. No sizing shall be applied to the yarn.
- (d) Count and Strength. The yarn shall have a count and strength sufficient to make a fabric which will meet the specifications.

4. Detailed Requirements of the Fabric.

- (a) Weave. The weave shall be plain.
- (b) Sizing. No sizing shall be applied to the fabric.
- (c) Length of Rolls. A roll shall consist of a "cut" not shorter than 40 yards and not longer than 120 yards.
- (d) Construction, etc. The thread count, weight, width, and breaking strength of the various types of fabrics shall be as follows, except as noted in the tolerances:

Designation:	Weight per: 1/ square yd.	Thread count :		Width :	Minimum average break- ing strength (grab method)	
		Warp	Filling		2/ Warp	Filling
	Ounces			Inches	Pounds	Pounds
A-1	5.30	12	12	90	45	45
A-2	5.30	12	12	82	45	45
A-3	5.30	12	12	74	45	45
B-1	4.25	9	9	90	35	35
B-2	4.25	9	9	82	35	35
B-3	4.25	9	9	74	35	35
C-1	3.20	7	7	90	25	25
C-2	3.20	7	7	82	25	25
C-3	3.20	7	7	74	25	25

1/ The designation A, B, and C denotes the type of fabric. The subscripts 1, 2, 3, refer to the standard widths of these fabrics, 90 inches wide, 82 inches, and 74 inches, respectively. These designations are to be used in filling out applications.

2/ The widths of 74, 82, and 90 inches are intended for use in surfaces 18, 20, and 22 feet wide, respectively, thus providing that the surface will be covered with three strips of fabric with laps of approximately 3 inches.

5. Tolerances.

- (a) Thread count. A total plus or minus tolerance of two threads per five inches in a combination of warp and filling will be permitted.
- (b) Width. A tolerance of plus or minus one inch from the width specified will be permitted.
- (c) Breaking strength. The combined strength of the warp and filling in the fabric shall equal or exceed the combined strength of those elements given in the above table and neither element shall be more than 10 percent under the requirements.
- (d) Weight. A tolerance of plus or minus 5 percent will be permitted.

6. Methods of Sampling and Testing

- (a) Sampling. Not less than one sample, at least 1 yard in length and the full width of the fabric, shall be taken at random from each 1,000 yards or fraction thereof, except when the shipment is over 10,000 yards, in which case at least one sample shall be taken from each one-tenth of the shipment.

- (b) Testing. Federal Specification CCC-T-191, Textiles; Test Methods, of the issue in effect on date of invitation for bids, wherever practicable, shall be followed.

7. Packing and Marking.

- (a) Packing. The fabric shall be shipped in rolls not to exceed 120 yards per roll and shall be covered with material so as to insure acceptance by common or other carrier, for safe transportation, at the lowest rate, to the point of delivery.
- (b) Marking. Unless otherwise specified, shipping containers shall be marked with the name of the material, the style, the width, the quantity contained therein, the name of the contractor, and the number of the order.

Request for Fabric

For the country as a whole sufficient fabric will be furnished, if requested, for approximately 1,000 miles of roads. Since some states may not be in a position to participate in the program or may wish to participate to only a small degree, it is believed that requests can be accepted for all reasonable amounts for demonstrational projects. So far as feasible, applications will be accepted immediately upon receipt. It is anticipated that approximately 60 days will be required for the manufacture of the fabrics. To obtain early delivery and insure the availability of materials, requests should be made promptly and all requests should be received by May 1, 1936.

Requests for fabric should be made in triplicate on the application form C. D. 3 and submitted to the District Engineers of the Bureau of Public Roads. The request should specify, for each type of fabric, the width and number of linear yards required (yardage of fabric and not of roadway to be covered).

